

A MODIFICATION OF THE CHINESE ISLAND FLAP TECHNIQUE FOR SIMPLE INCOMPLETE SYNDACTYLY RELEASE

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This paper presents a modification of the technique described by Yao et al. using a vascular island flap based on a dorsal digital vessel, which allows transfer of the web proximally and retains the integrity of the web skin. The technique was used in nine patients, aged from 1 to 15 years at operation, with nine incomplete simple syndactylies. The results were assessed at a mean of 36 (range 5–60) months after surgery. No vascular compromise or web creep was noted. This technique enables transfer of web skin proximally in cases of simple, incomplete syndactyly, avoids the presence of scars in the web space and does not require skin grafts.

Keywords: syndactyly, island web transfer, simple incomplete syndactyly, syndactyly correction, web space

Congenital syndactyly results from failure of developmental separation of adjacent digital rays (Eaton and Lister, 1990). It is the second most common congenital anomaly, with an incidence of 1 in 2000 live births (Dao et al., 2004; Savaci et al., 1999). Fifty per cent of cases are bilateral and it most commonly affects the third web space of the hand (Savaci et al., 1999).

Island web transfer is a technique used in simple, incomplete syndactyly whereby the web skin is transferred proximally as a vascular island flap based on the dorsal digital vessels (Yao et al., 1997). This transfer retains the integrity of the web skin and shape and is an alternative to reconstructing a web de novo after release of the syndactyly. Yao et al. (1997) moved the flap without dissection of the vessels of the pedicle and inset the subcutaneous tissue pedicle into the depth of the web. This paper describes a modification of this flap in which the dorsal digital artery is isolated and presents early results of using this technique for correction of simple, incomplete syndactyly extending to the proximal interphalangeal joint.

PATIENTS AND METHODS

Between 2004 and 2007, nine patients underwent surgery for simple, incomplete congenital syndactyly using the island web transfer technique. Five of the patients were boys and four were girls and their ages at the time of surgery ranged from 1 to 15 years (mean age 4.6 years).

Presentation: This study was presented at the British Association of Plastic Surgeons Winter 2006 Scientific Meeting and the British Society of the Surgery of the Hand Autumn 2006 Scientific Meeting.

Two patients presented late as a result of functional deficit in their teenage years.

All patients had a single web space involvement with simple incomplete syndactyly up to, or immediately distal to, the proximal interphalangeal joint. The syndactyly affected the second or third web in the left, non-dominant hand in all nine patients.

Surgical technique

Surgery was performed under general anaesthesia and tourniquet control without Esmark bandage exsanguination. For simple incomplete syndactyly extending beyond the proximal interphalangeal joint, we use interposing flaps, whereas Y-to-V-based incisions are sufficient for syndactyly at, or proximal to, the proximal interphalangeal joint (Figs 1a and b). The incisions should extend proximally to the level of the normal web spaces (Figs 2a and b). The web flap is raised dorsally taking care to visualise and preserve the dorsal digital artery to the flap (Fig 3). The flap is raised on a pedicle containing the arterial branch and its surrounding subcutaneous tissue (Fig 4). The mid-lateral incisions on the fingers are closed directly and the island flap is inset after being moved proximally to the appropriate level (Fig 5). On the palmar aspect, Z-plasties are incorporated into both the flap and the palmar skin (Fig 6) in order to reduce the risk of contracture. After being inset into the palm, the skin is closed with absorbable sutures and a bulky hand dressing applied. The operative time for each web space is approximately 45 minutes.

The dressing is left undisturbed for 14 days. On removal, full mobilisation is started. Fig 7 demonstrates

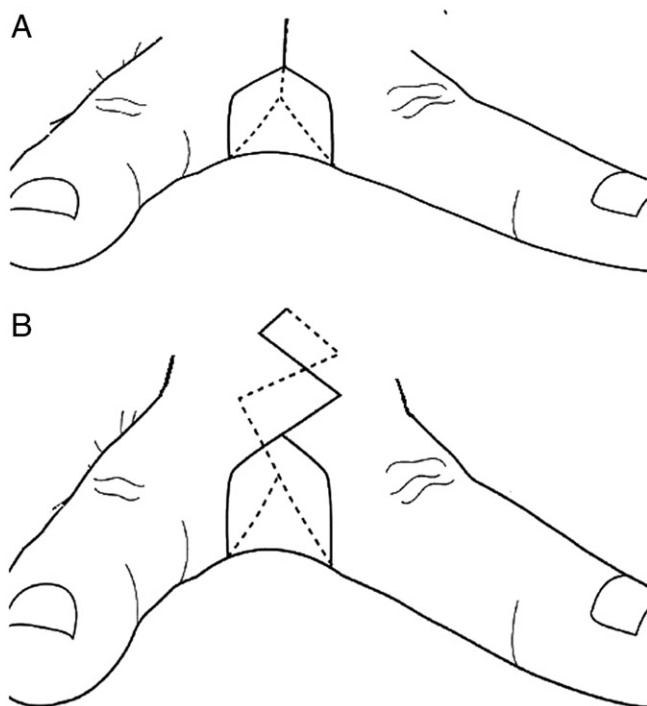


Fig 1 (A) Illustration of the Y-to-V incisions used for simple incomplete syndactyly correction at or proximal to the proximal interphalangeal joint. (B) Illustration of the interposing flaps used for simple incomplete syndactyly extending beyond the proximal interphalangeal joint.

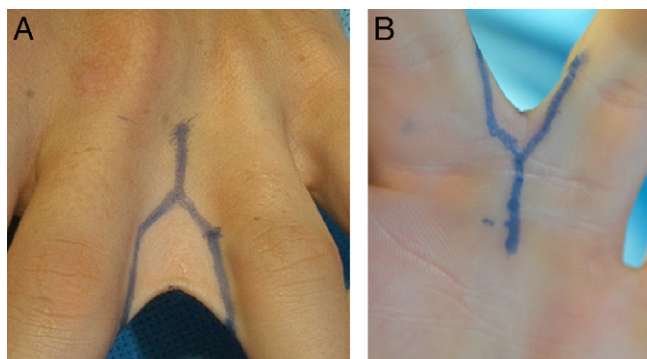


Fig 2 (A) Pre-operative Y-to-V-based incisions on the dorsum of the hand. (B) Pre-operative Y-to-V-based incisions on the palm.

the pre-operative deformity and Figs 8a and b show the results at 21 months after surgery.

Assessment

Note was made of complications at surgery or during the immediate postoperative period, including vascular compromise of the fingers or the flap, haematoma formation or infection. Postoperatively, all the patients were assessed at regular intervals for web creep, general

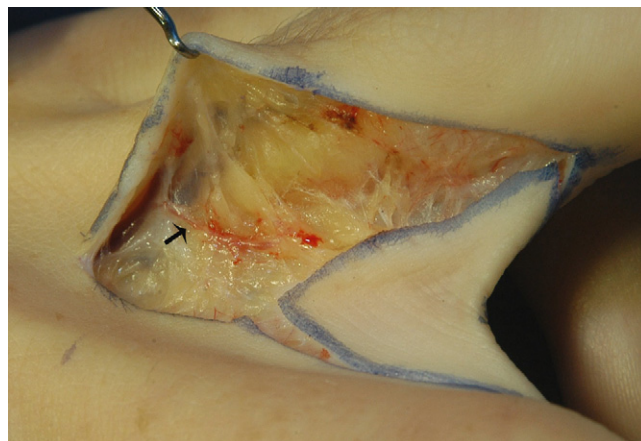


Fig 3 The flap is initially raised from dorsally. The dorsal digital artery (marked with arrow) is isolated and preserved as shown.

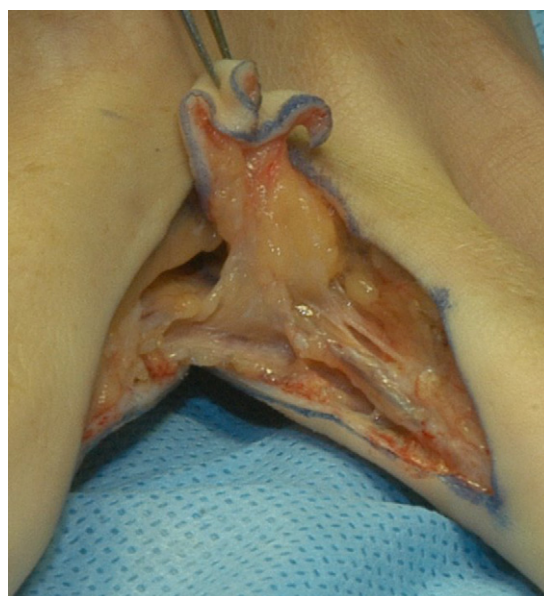


Fig 4 The flap is raised on a pedicle containing the artery and the surrounding subcutaneous tissue.

appearance of the web and degree of scarring. This was done subjectively by the senior author (McArthur P.) by comparison with the adjacent and contralateral web.

RESULTS

The artery was visualised in all cases, ensuring flap viability. There were no complications at surgery or during the immediate postoperative period, such as vascular compromise of the fingers or the flap, haematoma formation or infection.

The patients were reviewed retrospectively for this study at a mean of 36 (range 5–60) months. To date, none of the cases were noted to have web creep or



Fig 5 The island flap is inset dorsally and the mid-lateral incisions on the fingers are closed directly.

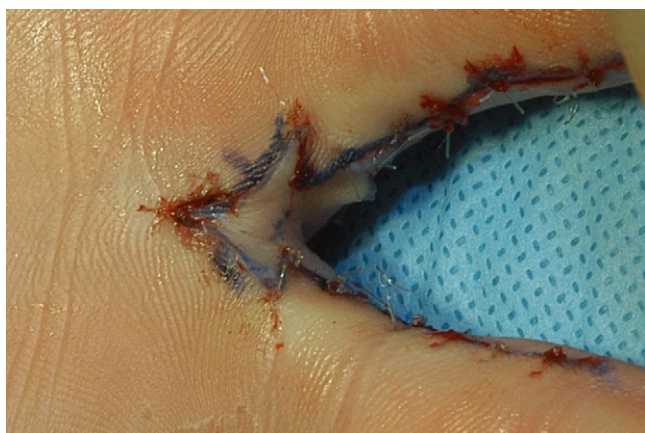


Fig 6 Z-plasties are incorporated into the volar part of flap and it is inset into the palm.

required any revisional surgery, although we acknowledge that the follow-up time of our series is short.

DISCUSSION

The main goals at surgery for simple incomplete syndactyly are to move the level of the web proximally by redistributing the available skin, while retaining the natural slope of the web space, and closing the skin defects on the lateral aspects of the fingers. In the longer term, surgery hopes to cause minimal scarring both in the web and in the dorsum of the hand and avoid web space narrowing or web creep.

Numerous surgical techniques have been described over the years for correction of this problem. Though the objectives are the same, differences of thought exist in the means of reconstruction of the interdigital web (Karacaoglan et al., 1993). A dorsal triangular, or rectangular, flap or a combination of interdigitating dorsal and volar triangular flaps may be used to reconstruct the web (Bauer et al., 1956; Cronin, 1956;



Fig 7 The pre-operative deformity in a 15-year-old boy with a simple, incomplete syndactyly of the third web space of his left hand to the level of the proximal interphalangeal joint.

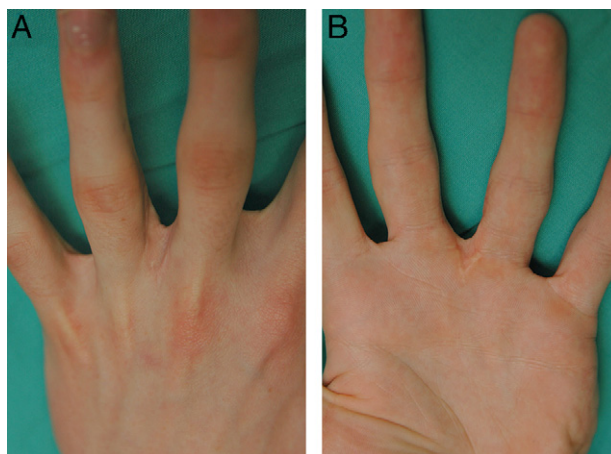


Fig 8 (A,B) The left hand of the same patient 3 months post-operatively.

Davis and German, 1930). For less-severe incomplete syndactyly, Z-plasties have been used to deepen the web space. Z-plasties however produce only mild deepening, disrupt the skin of the space and produces an angular, non-sloping web space. Brennen and Fogarty (2004) commented that many of these techniques are complex, result in excessive dorsal scarring and fail to retain the natural slope of the web space.

A distally based dorsal hand flap based on a direct cutaneous branch of the dorsal metacarpal artery has been used by many authors to reconstruct the web (Aydin and Ozden, 2004). Colville (1989) advocated a dorsal advancement kite flap in which the ulnar side of the cleft was closed directly but the radial side required skin grafts. In a series of 57 cases with a minimum follow-up of 2 years, two cases of graft failure requiring revision were reported, highlighting the potential drawbacks of this method. Since then, several modifications of this technique have been described. Sherif (1998) advocated a V–Y advancement: Aydin and Ozden (2004) a transposition flap that can be rotated by 0° to 180°, allowing a versatile coverage of both the finger base and the web itself, while Teoh and Lee (2004) described a dorsal pentagonal island flap. None of the more recent methods require the use of skin grafts. Although dorsal metacarpal artery flaps do appear to be reliable, they do have the disadvantage of a scar on the dorsum of the hand, the potential to move hair-bearing skin into the web space if proximal metacarpal skin is used and are of limited use in cases of multiple web syndactyly due to the limited donor area (Table 1). They also fail to maintain the integrity of the web skin and both the volar junctional scars and skin grafts increase the risk of web creep (Moss and Foucher, 1990).

Various techniques of harvesting island flaps from the syndactylised web have also been described more recently. Brennen and Fogarty (2004) divide the skin of the web into four flaps: two proximally based flaps for the central part of the web and two island flaps for the lateral part of the web. Although this technique disrupts the free margin of the web causing scarring in the web space, no long-term web creep or late complications were noted in a series of nine webs. However, as in this

series, follow-up time was short with a maximum follow-up of 60 months. They suggest that the non-linear nature of the scarring reduces the recurrence of webbing.

Yao et al. (1997) used a web flap in eight simple, incomplete syndactylies in seven patients extending up to the proximal interphalangeal joint. The flap was pedicled on the subcutaneous tissue and deep fascia of the web and fingers and no specific vessel was isolated with the flap. They demonstrated sensate, vascularised flaps in all seven patients. The intention of this technique was to retain the normal anatomy of the glabrous skin of the web space. This has an hourglass configuration, wider distally than proximally and sloping in a 40° angle from proximal-dorsal to distal-dorsal (Savaci et al., 1999; Tan et al., 2005), the shape of which is maintained by the natatory ligament system (Green et al., 2005). Transfer of the complete web also causes minimal scarring of the web and on the socially visible dorsal part of the hand and recreates a web with perfect match of skin colour, texture and thickness. The technique can also be used for multiple syndactylies on the same hand. Our technique differs from that of Yao et al. (1997) in that the arterial feeding branch to the web flap was isolated and preserved in all five cases.

Full-thickness skin grafts have been used with several methods of syndactyly correction to cover the skin defects on the sides of the fingers at the bases of the fingers. Skin grafts have the potential for unpredictable scarring, contracture, web creep, hyperpigmentation, hair growth, donor site morbidity and, thus, can have a negative effect on the long-term success of reconstruction (Aydin and Ozden, 2004; Sherif and Magdi, 1998). Flaps that grow more with the patient are, therefore, superior to skin grafts and reduce the incidence of revisional surgery (Ekerot, 1996). The island web

Table 1—Summary of the advantages and disadvantages of distally based dorsal hand flaps and island web flaps

<i>Technique</i>	<i>Advantages</i>	<i>Disadvantages</i>
<i>Distally based dorsal flaps</i> Colville (1989) ¹ , Sherif and Magdi (1998), Aydin and Ozden (2004), Teoh and Lee (2004)	<ul style="list-style-type: none"> ● Reliable ● Skin grafts often unnecessary ● Low incidence of web creep 	<ul style="list-style-type: none"> ● Dorsal scarring ● Restricted use in multiple webs in the same hand ● Potentially hair bearing skin in web ● Not a reusable technique in cases of recurrence
<i>Island web flaps</i> Brennen and Fogarty (2004), Yao et al. (1997)	<ul style="list-style-type: none"> ● Does not require skin grafts ● Reduces dorsal digital scarring ● Creates a naturally inclined web space ● Can be used for multiple webs ● Low incidence of web creep ● Can be used for repeat procedures in cases of recurrence 	<ul style="list-style-type: none"> ● Scars in the web space ● Can be complex to design and perform

¹Colville (1989) in 57 cases of simple complete syndactyly, used skin grafts to cover the radial side of the cleft. Two patients required revision due to failure of grafts at the base of the radial digit.

transfer technique has the merit of not requiring skin grafts and avoiding the associated complications. The mid-lateral incisions of the fingers, which are, approximately, 1 cm in length, are the main potential source of contracture when using this technique.

This technique is used specifically for simple incomplete syndactyly at, or proximal to, the proximal interphalangeal joint. This series has a short follow-up, with a maximum follow-up time in one patient of 5 years. This may be too short to allow for final assessment but, to date, the nine patients have shown no tendency to web creep or contracture.

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